

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

REMARKS

Claims 1-10, 12, and 13 are pending in the application.

Claims 12 and 13 have been amended to comply with the grammatical correction noted by the Examiner. Accordingly, Applicant respectfully submits that the objection to Claims 12 and 13 has been overcome and requests that the objection be withdrawn.

Claim 1 has been amended. No new matter is added by the claim amendments. The claim amendments are fully supported by the original disclosure. Applicant respectfully submits that the claim amendments present no new issues requiring further consideration or search by the Examiner. In particular, as discussed below, the subject matter of the claim amendments finds a basis in the claims as previously presented, namely, prior to the amendments being made herein. Accordingly, Applicant respectfully requests entry and consideration of the claim amendments.

Regarding the amendments made to Claim 1, the added recitations to an "upper" and "lower" vacuum vessel plate are supported by subject matter already existing in the version of the claims as previously presented (e.g., the Claim 2 recitation directed to "a vacuum vessel with a top and bottom plate"). Moreover, the added recitations to a "bellows" and "O-ring" are supported by subject matter already existing in the version of the claims as previously presented (e.g., the Claim 2 recitations pertaining to "bellows" and "O ring").

Briefly, referring to one form of the invention (Fig. 2), the arrangement of cylinder 107, O-ring 108, and bellows 106 provides, inter alia, a seal to hermetically separate the interior space of cylinder 107 (processing chamber 111) from the exterior space outside cylinder 107 (transport

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

chamber 112). The annular cylinder 107 is raised and/or lowered by a lifting/lowering mechanism 109, to facilitate both the hermetic sealing action and to enable a wafer to be exchanged between the transport chamber 112 and processing chamber 111.

In particular, according to one advantage of the invention, the location of the hermetic seal corresponds to the area where wafers are conveyed into and out of the processing chamber 111. Therefore, the structure for hermetic sealing -- namely, the assembly to provide airtight isolation of the processing chamber from the wafer transport chamber -- can be implemented with the same arrangement used to facilitate conveyance of the wafer into and out of the processing chamber.

Referring again to Fig. 1, cylinder 107 can be lowered to provide a gap with vacuum vessel top plate 103, through which a wafer is conveyed from transport chamber 112 to processing chamber 111 and placed on stage 105. Subsequently, to hermetically isolate processing chamber 111 from transport chamber 112 in preparation for wafer processing, cylinder 107 is raised into hermetic sealing engagement with vacuum vessel top plate 103 to thereby close-out the gap therebetween. (Page 9, lines 7-18; Page 10, lines 3-18.) This hermetic sealing arrangement is independent of any fixture associated with wafer stage 105, and therefore distinguishes from art such as the cited Takahashi reference, where the hermetic sealing components (bellows 22 and seal 21 relied upon by the Examiner) are integrally connected to structures associated with the wafer stage, namely, the movable support structure carrying the wafer (i.e., cover 19 which supports and carries wafer loading platform 18).

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

Claims 1-4, 6-10, and 12-13 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,580,420 to Watanabe et al. ("Watanabe") in view of U.S. Patent No. 5,314,574 to Takahashi.

Referring to base Claim 2, for example, the Examiner states in relevant part that Watanabe meets the claimed elements in the following manner (the corresponding claim recitations are enclosed in parenthesized quotations following the referenced Watanabe disclosures): (i) vacuum vessel 6 having a top plate 3, 66 and bottom plate 31 containing specimen stage 68 ("a vacuum vessel with a top and bottom plate" and "substrate stages"); and (ii) two cylinders (gate valve) 15 installed surrounding the substrate stage ("a plurality of cylinders provided respectively with an O ring connected to said bottom plate through bellows so as to surround said substrate stage").

The Examiner recognizes that Watanabe does not disclose, inter alia, the recited "O ring" and "bellows." ("Watanabe et al. does not expressly disclose ... that the cylinders are provided with an O-ring and that the cylinders are connected to the bottom plate through bellows.") However, relying upon the Takahashi disclosures pertaining to bellows 22 and sealing member 21, the Examiner states that it would be "obvious to one having ordinary skill in the art .. to modify the apparatus disclosed by Watanabe et al. as to further comprise the claimed O-ring and bellows [of Takahaski] in order to optimize the apparatus by tightly sealing the chamber and by freely expanding and compressing the lifting/lowering mechanism." (Insertion added.)

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

Applicant respectfully submits that it would not be obvious to make the proposed modification, as the Examiner maintains. There is no teaching or suggestion in the cited art to support the modification proposed by the Examiner, nor has the Examiner cited any prior art disclosures to substantiate the rationale (motivation to combine) that the Examiner relies upon to make the modification. Additionally, even if Watanabe was modified by Takahashi in a manner consistent with the teachings of both references, the resulting combination would not produce the invention as set forth in the claims.

Referring to Takahashi, the Examiner relies upon bellows 22 and sealing member 21 to find correspondence with the recitation of a "bellows" and "O ring", respectively, set forth in the claims. As shown by Figs. 1 and 3 of Takahashi, the arrangement of bellows 22 and sealing member 21 is provided in sealing relationship to disc-shaped cover 19, which carries loading platform 18 bearing wafer W. (Cover 19 is vertically movable by mechanism 24). Sealing member 21 is disposed at the upper surface of cover 19, while bellows 22 is disposed at the underside of cover 19. As shown in Fig. 1, the outer periphery of cover 19 overlaps with an annular shoulder 20 of container 2, so that a seal is formed between container 2 and cover 19 (at sealing member 21) as cover 19 is raised into contact with shoulder 20. (Col. 4, lines 27-53.)

Briefly, unlike the invention (Fig. 1), where the bellows 106 connects the cylinder 107 to bottom plate 102, and O-ring 108 is provided with cylinder 107, Takahashi instead employs bellows 22 to essentially connect the wafer stage 18 (via cover 19) to bottom plate 23, while the sealing member 22 of Takahashi connects cover 19 to container 2 (shoulder 20). The hermetic

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

seal of Takahashi is formed by actuation of air cylinder 24, which raises cover 19 (and wafer platform 18) until there is sealing contact (via sealing member 21) between the upper surface of cover 19 and shoulder 20 of container 2. The invention, though, has a stationary wafer stage 105, and instead uses the raising and lowering functionality provided by lifting/lowering mechanism 109 to adjust the vertical position of cylinder 107 (and O-ring 108) to selectively control the gap (and hermetic seal) formed with top plate 103. (The stationary feature is not being argued herein as a basis for patentability.)

Takahashi states in relevant part concerning its hermetic sealing arrangement:

The loading platform 18 is arranged atop the intermediate cover 19. For sealing against an annular shoulder 20 projecting inwardly from the container 2, the circumference edge of the intermediate cover 19 has a third sealing member 21 made of a corrosion resistant material. When the intermediate cover 19 is pressed upward against the shoulder 20, a hermetically sealed condition is established.

In addition, as indicated in FIG. 3, one end (upper end in the figure) of a second bellows 22, ... is hermetically connected to the outer circumference edge of the intermediate cover 19. The other end (lower end in the figure) of this bellows 22 is hermetically connected to a bottom cover 23. (Col. 4, lines 27-42.)

The hermetic sealing arrangement of Takahashi is completely different than the hermetic sealing structure of the invention. While the hermetic sealing components in Takahashi (bellows 22 and sealing member 21) are configured solely with wafer stage 18 (via attachment to wafer support cover 19), the invention employs bellows 106 and O-ring 108 with a cylinder 107 that surrounds wafer stage 105. Nevertheless, as best understood, the modification proposed by the Examiner would modify the cylinders (gate valve) 15 of Watanabe to incorporate bellows 22 and sealing member 21 of Takahashi, even though neither reference teaches or suggests the use of

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

such components (bellows 22 and sealing member 21) in connection with a cylinder that surrounds the wafer stage. Rather, Takahashi teaches the use of such components exclusively and solely with a wafer stage. Moreover, while the Examiner proposes to modify gate valve 15 of Watanabe to incorporate the hermetic seal components of Takahashi, Watanabe teaches differently and instead discloses hermetic sealing at a location (loading member 34) that is completely separate and apart from gate valve 15. There is no teaching or suggestion in the cited art to support the modification proposed by the Examiner, nor has the Examiner cited any prior art disclosures to substantiate the rationale (motivation to combine) that the Examiner relies upon to make the modification.

Applicant respectfully submits that Takahashi effectively teaches away from the proposed modification to Watanabe, since Takahashi deploys bellows 22 and sealing member 21 in a manner completely different than the invention (i.e., attachment of bellows 22 and seal 21 to wafer support cover 19 rather than to an annular cylinder that surrounds the wafer stage as in the invention.) Generally, though, neither reference teaches or suggests the modification proposed by the Examiner, by way of an express, implied, or inherent disclosure required to support the modification. Additionally, as discussed below, Watanabe itself provides a structure for hermetic sealing different from both the invention and Takahashi, which at least serves to undermine the assertion that the modification proposed by the Examiner is obvious, and also evidences a lack of nexus between the teachings of Watanabe and Takahashi to support a finding of obviousness. Notwithstanding the teach away disclosures, the modification proposed by the

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

Examiner would, at best, be founded upon an impermissible obvious to try rationale. Applicant respectfully submits, though, that the proposed combination could only be produced by the use of impermissible hindsight construction from Applicant's disclosure.

The manner of the proposed modification is not manifestly apparent from the statement of rejection. However, based on the Examiner's identification of correspondence between the Watanabe disclosures (gate valve 15, top plate 3) and the relevant claim limitations, it appears that the modification envisions the interposition of sealing member 21 (Takahashi) between gate valve 15 and top plate 3 (Watanabe), and the connection of bellows 22 (Takahashi) to gate valve 15. However, this modification is not supported by the references, much less obvious to one skilled in the art, for the reason that there is no teaching or suggestion regarding the desirability of this specific modification, and the modification is not consistent with the Takahashi disclosures specifically concerning the deployment of bellows 22 and sealing member 21 only with a wafer stage cover.

At best, Takahashi indicates -- in connection with sealing member 21 and bellows 22 relied upon by the Examiner -- that these components can be placed in sealing relationship to a wafer stage carrying the semiconductor wafer, i.e., cover 19 that carries platform 18 laden with wafer W. Nowhere does Takahashi disclose the use of these components in connection with a cylinder that surrounds wafer platform 18. Hence, Takahashi neither teaches nor suggests assembling an O-ring and bellows with a cylinder that surrounds the wafer substrate stage, as in the invention.

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

Accordingly, one skilled in the art would not recognize the utility -- and still less the obviousness -- of employing sealing member 21 and bellows 22 from Takahashi with gate valve 15 and plate 3 of Watanabe, in the manner proposed by the Examiner. Even if one skilled in the art considered Watanabe in view of Takahashi, the skilled artisan would only recognize (if at all) that the relevant context for utilizing sealing member 21 and bellows 22 of Takahashi would be wafer specimen stage 68 of Watanabe, and not gate valve 15 as the Examiner proposes. In particular, since cover 19 (which supports wafer stage 18) is the only relevant structure taught by Takahashi for integral deployment of sealing member 21 and bellows 22, the skilled artisan would likewise only look to wafer specimen stage 68 in Watanabe -- and not to gate valve 15 -- for any consideration of where to deploy (if at all) structures comparable to sealing member 21 and bellows 22.

Indeed, Applicant believes that the skilled artisan would not incorporate sealing member 21 and bellows 22 into the Watanabe apparatus, whether for the purpose proposed by the Examiner or otherwise. First, the Watanabe wafer stage 68 could not accommodate sealing member 21 and bellows 22 in the same manner as taught by Takahashi, much less in the manner proposed by the Examiner which is neither taught nor suggested. The necessary overlap between cover 19 and shoulder 20 in Takahashi -- which is essential to the sealing function of sealing member 21 -- is nowhere apparent in Watanabe as applied to the comparable structure of wafer stage 68 relative to its surroundings.

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

Nevertheless, even if Watanabe did incorporate the teachings of Takahashi concerning sealing member 21 and bellows 22, the resultant combination would not produce the invention, since these components would be integrated with specimen stage 68 (and not gate valve 15) consistent with the Takahashi teachings. It is apparent, then, that since the only conceivable modification to Watanabe based on Takahashi (i.e., integration of sealing member 21 and bellows 22 with specimen stage 68) would itself not be readily perceived as obvious by one skilled in the art, it is even much more apparent that the modification proposed by the Examiner - which is neither taught nor suggested by either reference -- would not be obvious to one skilled in the art.

Second, although Takahashi does disclose that gate valve 15 serves as "a ring gate for partitioning off the buffer chamber 3 to form the processing chamber 6", it is loading member 34 (and not gate valve 15) that provides the hermetic sealing, making it even less likely that one skilled in the art would recognize that gate valve 15 could be configured with sealing components such as bellows 22 and sealing member 21 of Takahashi, and still less that such a modification would be obvious. (Col. 7, lines 20-25.) ("Then a loading member 34 is forced by the wafer lifting mechanism 14 to airtightly contact the bottom of the load lock chamber 4 to form a load lock chamber..." at Col. 8, lines 20-23.) (Col. 13, lines 45-48.)

Applicant respectfully submits that the proposed modification can only be sustained on the basis of impermissible hindsight construction from Applicant's disclosure, or, at best, on the basis of an impermissible obvious to try rationale.

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

Regarding the rationale offered in support of the modification, namely, "to optimize the apparatus by tightly sealing the chamber and by freely expanding and compressing the lifting/lowering mechanism", Applicant submits that this rationale has no express or implied basis in the cited references, as it pertains to the specific modification proposed by the Examiner, i.e., integration of bellows 22 and sealing member 21 (Takahashi) with gate valve 15 (Watanabe). The Examiner cites no disclosure from either reference to support this specific modification.

Nevertheless, apart from the lack of any citation from the disclosures to substantiate the proposed motivation to combine, Applicant believes that the rejection cannot be sustained since the references teach away from the proposed modification; there is no teaching or suggestion in either reference to support the modification; and the resulting combination would not produce the invention even if Watanabe was modified in view of Takahashi consistent with the teachings of both disclosures.

In view of the foregoing, Applicant respectfully submits that Claims 1 and 2 are patentably distinguishable over Watanabe in view of Takahashi, and respectfully requests that the rejection of independent Claims 1 and 2 (and Claims 3-4, 6-10, and 12-13 dependent therefrom) be withdrawn.

Claim 5 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Watanabe in view of Takahashi, as applied to Claims 1-4, 6-10, and 12-13 above, and further in view of JP10-177994 to Masahiro et al. ("Masahiro").

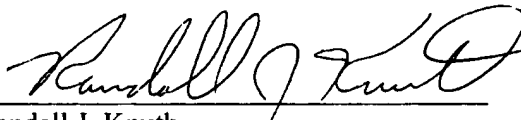
Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

Applicant believes that Claim 5 is patentably distinguishable over Watanabe in view of Takahashi and Masahiro because it depends from patentably distinguishable base Claim 1, and respectfully requests that this rejection be withdrawn.

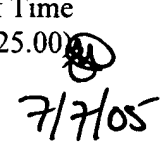
Applicant believes that the application is in condition for allowance and respectfully requests favorable action in accordance therewith.

If the Examiner has any questions or comments that would advance prosecution of this case, the Examiner is invited to call the undersigned at 260/484-4526.

Respectfully Submitted,


Randall J. Knuth
Registration No. 34,644

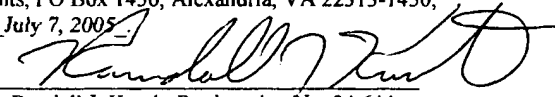
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Enclosures: Amendments to the Claims
(5 Sheets)
Explanatory Cover Sheet - Page 1
Petition for Extension of Time
Check No. 8714 (\$225.00) 
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Customer No.: 022855
RANDALL J. KNUTH, P.C.
4921 DeSoto Drive
Fort Wayne, IN 46815
Telephone (260) 484-4526
Facsimile (260) 484-0185
Email:

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, PO Box 1450, Alexandria, VA 22313-1450, on: July 7, 2005.


Randall J. Knuth, Registration No. 34,644

July 7, 2005
Date

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

AMENDMENTS TO THE CLAIMS

1. (CURRENTLY AMENDED) A semiconductor manufacturing apparatus for processing a substrate surface, said apparatus comprising:

a vacuum vessel having [[a]] an upper vacuum vessel plate
5 and a lower vacuum vessel plate;

a substrate stage fixedly provided on said lower vacuum vessel plate, said substrate stage having an operatively immovable substrate receiving portion;

a cylinder installed surrounding said substrate stage, a
10 gap existing between said cylinder and said upper vacuum vessel plate, said gap being made variable by lifting/lowering said cylinder, said cylinder having a cylinder interior space and a cylinder exterior space associated therewith, said cylinder interior space defining a processing chamber for processing said
15 substrate surface, said cylinder exterior space including a transport chamber for transferring said substrate;

a bellows extending between said cylinder and said lower vacuum vessel plate;

an O-ring disposed on said cylinder;

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

20 at least one cylinder lifting/lowering mechanism being
operatively associated with said cylinder;

 a substrate conveyer mechanism provided with said transport
chamber, said substrate conveyer mechanism for transferring said
substrate between said processing chamber and said transport
25 chamber through said gap;

 said processing chamber being provided with a processing
chamber gas inlet and a processing chamber gas outlet; and

 said transport chamber being provided with a transport
chamber gas inlet and a transport chamber gas outlet.

2. (PREVIOUSLY PRESENTED) A semiconductor manufacturing
apparatus for processing a substrate surface, the apparatus
composed of a vacuum vessel with a top and bottom plate, said
apparatus comprising:

5 a plurality of substrate stages fixedly provided on said
vacuum vessel bottom plate, each of said substrate stages
respectively having an operatively immovable substrate receiving
portion;

 a plurality of cylinders provided respectively with an O
10 ring connected to said bottom plate through bellows so as to
surround said substrate stage, said cylinders forming a gap with

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

said vacuum vessel top plate, a gap between said cylinder and
said vacuum vessel top plate being made variable by
lifting/lowering said cylinder, and at a position where said gap
15 becomes minimum, a plurality of cylinder lifting/lowering
mechanisms operatively associated with said cylinder being
provided, in order to hermetically separate an interior space
inside said cylinder from an exterior space outside thereof,
said interior space forming a processing chamber for processing
20 said substrate surface, the exterior space defining a transport
chamber for transferring said substrate;

said transport chamber being provided with a substrate
conveyer mechanism for transferring said substrate between said
processing chamber and said transport chamber through said gap;

25 said processing chamber being provided with a processing
chamber gas inlet and a processing chamber gas outlet; and

said transport chamber being provided with a transport
chamber gas inlet and a transport chamber gas outlet.

3. (PREVIOUSLY PRESENTED) The semiconductor manufacturing
apparatus according to Claim 1, wherein said vacuum vessel
having a modular configuration, the modular configuration
including a first modular unit having said processing chamber

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

5 and a second modular unit having said substrate transport mechanism.

4. (PREVIOUSLY PRESENTED) The semiconductor manufacturing apparatus according to Claim 1, further comprising a plasma generation mechanism for generating plasma in said processing chamber.

5. (PREVIOUSLY PRESENTED) The semiconductor manufacturing apparatus according to Claim 4, wherein said plasma generation mechanism radiates microwave energy through a slot antenna.

6. (ORIGINAL) The semiconductor manufacturing apparatus according to Claim 4, wherein a plurality of cylindrical permanent magnets are disposed substantially on the circumference surrounding the substrate in the atmosphere
5 outside said vacuum vessel, in order to impress magnetic field around said substrate.

7. (PREVIOUSLY PRESENTED) The semiconductor manufacturing apparatus according to any one of Claims 1 to 6, wherein said substrate stage is provided with a means for impressing direct current or alternating current power.

8. (PREVIOUSLY PRESENTED) The semiconductor manufacturing apparatus according to Claim 2, wherein said vacuum vessel

Application No.: 09/581,878
Attorney Docket No.: FUK-71
Amendment Dated: July 7, 2005
Reply for Office Action Dated: February 7, 2005

having a modular configuration, the modular configuration
including a first modular unit having said processing chamber
and a second modular unit having said substrate transport
mechanism.

9. (PREVIOUSLY PRESENTED) The semiconductor manufacturing
apparatus according to Claim 2 comprising a plasma generation
mechanism for generating plasma in said processing chamber.

10. (PREVIOUSLY PRESENTED) The semiconductor manufacturing
apparatus according to Claim 3 comprising a plasma generation
mechanism for generating plasma in said processing chamber.

11. (CANCELED)

12. (CURRENTLY AMENDED) The semiconductor manufacturing
apparatus according to Claim 1, wherein the immovable substrate
receiving portion of said substrate stage ~~defining~~ defines an
upper end of said substrate stage.

13. (CURRENTLY AMENDED) The semiconductor manufacturing
apparatus according to Claim 2, wherein the respective immovable
substrate receiving portion of each substrate stage ~~defining~~
defines an upper end of said substrate stage associated
therewith.